

CLAIMS

WE CLAIM:

1. A charging system for an unmanned underwater vehicle, comprising:
 - an electrical port adapted to electrically couple to an unmanned underwater vehicle (UUV);
 - a fluid-powered turbine adapted to receive a flow of fluid and configured, upon receipt thereof, to rotate;
 - a generator coupled to the turbine and configured, upon rotation thereof, to generate electrical power; and
 - a controller adapted to receive a UUV docking signal that indicates at least that the electrical port is electrically coupled to the UUV and operable, in response thereto, to selectively electrically couple the generator to the electrical port.
2. The system of Claim 1, further comprising:
 - a battery,
 - wherein the controller is further adapted to receive one or more signals representative of at least a state of charge of the battery and is further operable, in response thereto, to selectively electrically couple the generator to the battery, to thereby recharge the battery to a predetermined state of charge.
3. The system of Claim 1, wherein the controller is further responsive to the UUV docking signal to selectively activate and deactivate the generator, whereby the generator generates electrical power and does not generate electrical power, respectively.
4. The system of Claim 1, wherein the fluid-powered turbine comprises a Gorlov turbine.

5. The system of Claim 1, further comprising:
a data transfer module adapted to receive data from the UUV and transfer the received data to data receptor.
6. The system of Claim 5, wherein the data transfer module is electrically coupled to receive power from either, or both, the battery or generator.
7. The system of Claim 1, further comprising:
a UUV docking control module adapted to receive a signal representative of the docking status of the UUV and operable, in response thereto, to supply the UUV docking signal.
8. The system of Claim 7, wherein the UUV docking control module is electrically coupled to receive power from either, or both, the battery or generator.
9. The system of Claim 2, further comprising:
a secondary generator configured to at least selectively generate electrical power.
10. The system of Claim 9, wherein:
the secondary generator is further configured to selectively generate electrical power; and
wherein the controller is further adapted to receive one or more signals representative of a power delivery capability of the turbine and is further operable, in response thereto, to selectively activate the secondary generator and selectively electrically couple the secondary generator to the battery.

11. The system of Claim 9, wherein the controller is further adapted to receive one or more signals representative of a power delivery capability of the turbine and is further operable, in response thereto, to selectively electrically couple the secondary generator to the battery.

12. The charging system of Claim 1, wherein the controller is further operable, in response to the UUV docking signal, to supply one or more switch command signals, and wherein the system further comprises:

a switch coupled between the electrical port and the fuel cell and moveable between an open position, in which the fuel cell is not electrically coupled to the electrical port, and a closed position, in which the fuel cell is electrically coupled to the electrical port,

wherein the switch is further coupled to receive the switch command signals and is operable, in response thereto, to selectively move between the open and closed positions.

13. The charging system of Claim 1, wherein the controller is further coupled to receive a signal that indicates a type of rechargeable power source that is on-board the UUV and is further operable, in response thereto, control a recharge operation of the rechargeable power source based at least in part on the power source type.

14. A docking station for an unmanned underwater vehicle (UUV), comprising:

a housing;

a UUV docking port disposed within the housing and configured to dock a UUV therein;

an electrical port disposed at least partially within the UUV docking port, the electrical port adapted to electrically couple to a docked UUV;

a battery;

a fluid-powered turbine adapted to receive a flow of fluid and configured, upon receipt thereof, to rotate;

a generator coupled to the turbine and configured, upon rotation thereof, to generate electrical power; and

a controller adapted to receive a UUV docking signal that indicates at least that the electrical port is electrically coupled to the UUV and operable, in response thereto, to selectively electrically couple the generator to the electrical port.

15. The UUV docking station of Claim 14, further comprising:

a sensor adapted to sense at least when a UUV is properly docked in the UUV docking port, and configured to supply a sensor signal representative thereof;

a UUV docking controller coupled to receive the signal from the sensor and operable, in response thereto, to supply the UUV docking signal to the charge controller.

16. The UUV docking station of Claim 14, further comprising:

a sensor adapted to sense at least when a UUV is properly docked in the UUV docking port, and configured to supply a sensor signal representative thereof to the charge controller,

wherein the sensor signal is the UUV docking signal.

17. The system of Claim 14, further comprising:
a battery,
wherein the controller is further adapted to receive one or more signals representative of at least a state of charge of the battery and is further operable, in response thereto, to selectively electrically couple the generator to the battery, to thereby recharge the battery to a predetermined state of charge.
18. The system of Claim 14, wherein the controller is further responsive to the UUV docking signal to selectively activate and deactivate the generator, whereby the generator generates electrical power and does not generate electrical power, respectively.
19. The system of Claim 14, wherein the fluid-powered turbine comprises a Gorlov turbine.
20. The system of Claim 14, further comprising:
a data transfer module adapted to receive data from the UUV and transfer the received data to data receptor.
21. The system of Claim 20, wherein the data transfer module is electrically coupled to receive power from either, or both, the battery or generator.
22. The system of Claim 14, further comprising:
a UUV docking control module adapted to receive a signal representative of the docking status of the UUV and operable, in response thereto, to supply the UUV docking signal.
23. The system of Claim 22, wherein the UUV docking control module is electrically coupled to receive power from either, or both, the battery or generator.

24. The system of Claim 17, further comprising:
a secondary generator configured to at least selectively generate electrical power.

25. The system of Claim 24, wherein:
the secondary generator is further configured to selectively generate electrical power; and
wherein the controller is further adapted to receive one or more signals representative of a power delivery capability of the turbine and is further operable, in response thereto, to selectively activate the secondary generator and selectively electrically couple the secondary generator to the battery.

26. The system of Claim 24, wherein the controller is further adapted to receive one or more signals representative of a power delivery capability of the turbine and is further operable, in response thereto, to selectively electrically couple the secondary generator to the battery.

27. The charging system of Claim 14, wherein the controller is further operable, in response to the UUV docking signal, to supply one or more switch command signals, and wherein the system further comprises:
a switch coupled between the electrical port and the fuel cell and moveable between an open position, in which the fuel cell is not electrically coupled to the electrical port, and a closed position, in which the fuel cell is electrically coupled to the electrical port,
wherein the switch is further coupled to receive the switch command signals and is operable, in response thereto, to selectively move between the open and closed positions.

28. The charging system of Claim 14, wherein the controller is further coupled to receive a signal that indicates a type of rechargeable power source that is on-board the UUV and is further operable, in response thereto, control a recharge operation of the rechargeable power source based at least in part on the power source type.

29. A method of charging a power source in an unmanned underwater vehicle (UUV), comprising the steps of:

electrically coupling an electrical port to at least a portion of the UUV power source;

activating an electrical generator; and

electrically coupling the electrical generator to the electrical port, to thereby charge the UUV power source using at least the electrical generator.

30. The method of Claim 29, further comprising:

determining a state of charge of a battery; and

based at least in part on the determined state of charge, selectively activating the electrical generator and selectively electrically coupling the electrical generator to the battery, to thereby recharge the battery to a predetermined state of charge.

31. The method of Claim 29, further comprising:

determining a docking status of the UUV.

32. The method of Claim 29, further comprising:

transferring data from the UUV while charging the UUV power source.

33. The method of Claim 29, wherein the UUV power source is one of a plurality of types of power sources, and wherein the method further comprises:

determining the type of rechargeable power source; and

charging the UUV power source based at least in part on its type.